REMARKS

Claims 1-27 are currently pending. Claims 25-27 have been added to round out the scope of protection being sought. Independent claims 1, 16 and 24 have been amended to bring out a patentable distinction of the present invention. Claim 12 has been placed in independent form with an additional change as explained below.

With respect to claim 1, it is noted the additional phrase of "without necessarily heating anything else" it is supported by the disclosure at page 6, lines 15-17, for example. The phrase "wherein said heating is restricted to the catalyst" in new independent claims 25 and 26 is supported by the original disclosure at page 7, lines 6-10, for example. Support for the recitation that the support structure (e.g., support or substrate) is not necessarily tolerant of a reaction temperature the catalyst is found at page 1, lines 26 through page 2 line 8, for example. Finally, support for claim 19 is found at page 5, lines 1-14, for example.

35 U.S.C. §112

The Office Action includes a rejection of claims 1 and 24 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. First, the Office Action questions whether "locally" is sufficiently definite, suggesting that it is a relative term that is not defined by the claim and the specification does not provide standard for ascertain the requisite degree such that one of ordinary skill in the art would not reasonably be apprised of the scope of the invention. Applicants respectfully disagree with this assertion insofar as it is clear at various points that "locally heating" and like phrases means the catalyst is the only material

that is necessarily heated, and other materials, such as the substrate or support, do not become heated, depending on the choice of material. There are many parts of the application that address this issue and a great deal of support for this underlining thought. Claims 1 and 16 have been amended and new independent claims 25 and 26 have been added to bring out this definition in two different ways.[1] It is believed that insofar as the amended claims have been amended to make express the meaning of the phrase "selectively and locally heating" as defined by the original application, withdrawal of this rejection is respectfully requested.

Second, the Office Action also suggests that the term "means for growing carbon nanotubes from the heated catalyst" in claim 24 is not associated with the physical entity. The undersigned appreciates the Examiner's comments in this regard and claim 24 has been amended accordingly.

In light of the above changes to the claims and comments, Applicants respectfully request reconsideration and withdrawal of this rejection.

35 U.S.C. §102(b)

The Office Action includes a rejection of claims 1, 2, 5, 7-10, 12-15 and 24 under 35 U.S.C. §102(b) as allegedly being anticipated by the Tennent et al. (U.S. Patent No. 5,165,909). This rejection is respectfully traversed.

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[1] Claim 16 is not presently under consideration but may be rejoined to the application.

The Tennent et al. patent is directed to a method of producing carbon fibrils. As illustrated in Figure 6, it includes a tower reactor which has strip heaters for heating the inside of a furnace to a requisite degree of 1100°C at one end. With reference to the various examples beginning at column 11, line 26, the various fibril synthesis runs are conducted in a furnace in which all materials in the furnace are heated to a reaction temperature.

At column 8, beginning at line 59, it is disclosed in the Tennent et al. patent that the reaction temperature "must be high enough to cause the catalyst particles to be active for fibril formation, yet low enough to avoid significant thermal decomposition of the gaseous carbon-containing compound with formulation of pyrolytic carbon". It then goes on to state that "[i]n cases where thermal decomposition of the gaseous carbon-containing compound occurs at a temperature near or below that required for an active fibril-producing catalyst, the catalyst particle may be heated selectively to a temperature greater than that of the gaseous carbon-containing compound[.] Such selective heating may be achieved, for example, by electromagnetic radiation." The only other mention of electromagnetic radiation heating of the catalyst is found in column 4, lines 45-50 where it is disclosed that "the surface of the metal-containing particle is independently heated, e.g., by electromagnetic radiation, to a temperature between about 850°C and about 1800°C, the temperature of the particle being higher then the temperature of the gaseous, carbon-containing compound."

As can be seen, the Tennent et al. patent does not teach or suggest the various features of the present invention which include that the support structure does not have to

be formed of a heat resistant material that can tolerate high reaction temperatures. Instead, the present inventors have discovered by selectively and locally heating the catalyst, the selection of a support structure is not restricted to materials that are tolerant of high amounts of heat.

Also, the Tennant et al. patent does not expand upon or specifically suggest what is meant by independently heating the surface of the metal-containing particle by electromagnetic radiation. Electromagnetic radiation is a broad term that includes gama radiation, x-rays, ultra violet, visible and infrared radiation as well as radar and radio waves. The passage in the Tennant et al. patent does not specifically identify any one of these mechanisms as being suitable. It is not clear to the undersigned what the Tennant et al. patent might mean by the phrase "electromagnetic radiation" in this context insofar the phrase could be viewed as literally including any one of these mechanisms, but some selections would seen counter-intuitive, such as dielectric heating by microwaves and simple light absorption such as from a bright light source, etc.

Further, the substantive examples of heating in the Tennent et al. patent are described only as "heating" by an electric furnace or tower reactor type furnace. Radiation generated by an electric heater may be described as "electromagnetic radiation" in the form of infrared radiation. It would not seem reasonable to extend this understanding to "microwave heating" or "induction heating" without a stronger suggestion in the prior art.

The undersigned respectfully submits that one reading this passage of the Tennent et al. patent would not think of microwave heating insofar as placing metals into microwave ovens causes sparks but little heating due to a shorting effect. This is not the case in the

context of the present invention insofar as the catalyst are not shorted together. It is respectfully submitted that the mention of "electromagnetic radiation" as heating the surface of metals would not suggest to one of ordinary skill in the art the use of microwaves, at least in the context of the Tennent et al. patent. Hence, with respect to microwaves, Applicants respectfully submit that claim 12, as placed in independent form, is patentably distinct.

Similarly, one would not anticipate the use of laser light insofar as such mechanism is complicated by the idea of shining laser beams onto individual catalyst particles. If such a disclosure were intended or suggested by the Tennent et al. patent, surely more details would have been offered.

With respect to independent claims 1, and 16-18, it is noted that the Tennent et al. patent neither nor suggests that a support structure, such as a catalyst support or substrate, that is not necessarily tolerant to the reaction temperature of the catalyst can be used. It is counter-intuitive to think that a catalyst on the support structure has to be heated to a given temperature for a reaction to occur, but the support structure does not have to be tolerant of that temperature. It is also noted that in the particular embodiments and examples at the end of the Tennent et al. patent, only a ceramic substrate is disclosed as being used to support the catalyst.

Hence, it is respectfully submitted that at least this counter-intuitive aspect to the present invention patentably distinguishes itself from the Tennent et al. patent.

35 U.S.C. §103

The Office Action also includes a rejection of claims 3 and 4 under 35 U.S.C. §103 as allegedly being unpatentable over the Tennent et al. patent and further in view of the Mandeville et al. patent (U.S. Patent No. 6,423,288); and a rejection of claim 6 and 11 under 35 U.S.C. §103 as allegedly being unpatentable over the Tennent et al. patent in view of the Kambe et al. patent (U.S. Patent No. 6,045,769). These rejections are respectfully traversed.

The Mandeville et al. patent is merely applied for teaching various methods of loading a catalyst and the Kambe et al. patent is applied for merely disclosing a reactant stream can include other reactants such as hydrogen gas or hydrogen sulfide. As such, these patents, even assuming *arguendo* that they fully support the propositions for which they are offered, would not cure the deficiencies of the rejections as articulated above with respect to the Tennent et al. patent. Accordingly, Applicants respectfully request reconsideration and withdrawal of these rejections as well.

In light of the foregoing, Applicants respectfully request that the rejections of record be withdrawn and the present application pass issuance. Should any residual issues exist, the Examiner is invited to contact the undersigned at the number listed below.

Respectfully submitted,

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Attachment to Amendment dated February 20, 2003
Mark-up of Claims

1. (Amended) A method of synthesizing carbon nanotubes, comprising the steps of:

introducing a catalyst in a reactor on a support structure that is not necessarily tolerant of a reaction temperature of the catalyst;

supplying a reactant gas containing a carbon source gas over the catalyst;

selectively and locally heating the catalyst in the reactor, without necessarily heating anything else, to the reaction catalyst temperature; and

growing carbon nanotubes from the heated catalyst.

12. (Amended) A method of synthesizing carbon nanotubes, comprising the steps of:

introducing a catalyst in a reactor;

supplying a reactant gas containing a carbon source gas over the catalyst;

selectively and locally heating the catalyst in the reactor without necessarily heating anything else; and

growing carbon nanotubes from the heated catalyst,

[The method of claim 1,] wherein the local heating of the catalyst is performed by irradiation of microwaves.

Attachment to Amendment dated February 20, 2003

16. (Amended) An apparatus for synthesizing carbon nanotubes, comprising:

a reactor for receiving a catalyst on a support structure that is not necessarily tolerant of a reaction temperature of the catalyst;

a reactant gas supplier for supplying a carbon source gas into the reactor; and

a local heater for selectively heating the catalyst received in the reactor, without necessarily heating anything else, to the reaction temperature of the catalyst.

24. (Amended) An apparatus for synthesizing carbon nanotubes, comprising:

[means] a support structure for introducing a catalyst in a reactor that is not necessarily tolerant of a reaction temperature of the catalyst;

means for supplying a reactant gas containing a carbon source gas over the catalyst; and

means for selectively and locally heating the catalyst in the reactor, such that the catalyst is heated to the reaction temperature of the catalyst without necessarily heating anything else, wherein [; and means for growing] carbon nanotubes are grown from the heated catalyst.